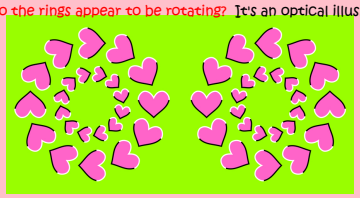
Rotations

Check out these other files
Reflections
Translations
Dilations

Transforming Geometry into the Common Core with Transformations

Do the rings appear to be rotating? It's an optical illusion.



http://www.psy.ritsumei.ac.jp/~akitaoka/rotate23e.html

with an Interactive Notebook foldable

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http://GeometryGems.wikispaces.com/imathination

Rotations Transformations

Menu

Table of Contents

Grade 8 Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software.

- CCSS.Math.Content.8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations:
  - CCSS.Math.Content.8.G.A.1a Lines are taken to lines, and line segments to line segments of the same length.
  - CCSS.Math.Content.8.G.A.1b Angles are taken to angles of the same measure.
  - CCSS.Math.Content.8.G.A.1c Parallel lines are taken to parallel lines.
- CCSS.Math.Content.8.G.A.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

Grade 8 Geometry p.1

Grade 8 Geometry (cont.)

Understand congruence and similarity using physical models, transparencies, or geometry software.

- CCSS.Math.Content.8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
- CCSS.Math.Content.8.G.A.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

Grade 8 Geometry p.2

High School Geometry

Understand similarity in terms of similarity transformations

- CCSS.Math.Content.HSG-SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor:
  - CCSS.Math.Content.HSG-SRT.A.1a A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
  - CCSS.Math.Content.HSG-SRT.A.1b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

HS Geometry p.1

High School Geometry (cont.)

Understand similarity in terms of similarity transformations

- CCSS.Math.Content.HSG-SRT.A.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
- CCSS.Math.Content.HSG-SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

HS Geometry p.2

Common Core Math Practices

The CCSSM expects mathematically proficient geometry students to

- experiment,
- explain,
- prove,
- visualize,
- understand,
- derive, and
- translate between representations.

Students are expected to demonstrate geometric habits of mind, and be proficient in the Standards of Mathematical Practice.

CCSS Math Practices

Transformations

The first use of transformations dates back to the ancient Greeks around the time of Euclid. However, not until Euler (in 1776) did anyone identify all the kinds of transformations in space that could yield congruent figures.

It is interesting that the 3-dimensional analysis of congruence was accomplished before the 2-dimensional. This is probably because the congruent objects seen daily are 3-dimensional.

Transformation History

rotations translations dilations reflections

A transformation is a correspondence between sets of points such that each point in the image has exactly one preimage point.

Transofrmation

Why study transformations?

- Studying these various transformations helps a person to become more aware of the movements of objects such as gears (which rotate) and conveyer belts (which slide).
- More complicated movements, such as those done by robots, can be taken apart into their component moves and analyzed.
- Transformations also appear in music and help to show some connections between mathematics and music.
- Things like cartoons, comics, flip books, storyboards, how-to books, and picture instructions use transformations to show motion

Why study transformations?

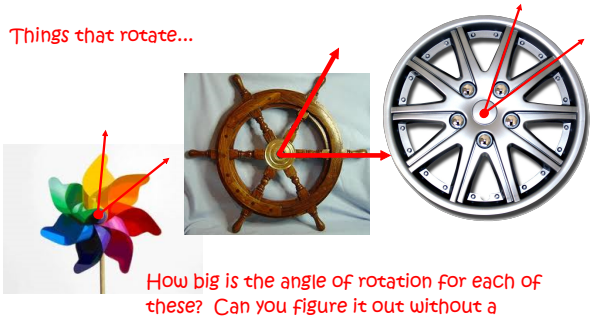
Definition

Rotation or "Turn"

A *rotation R* is a transformation of the plane that is the composite of two reflections over intersecting lines; the transformation **turns** the pre-image onto the image about a CENTER.

Rotation

Things that rotate...



How big is the angle of rotation for each of these? Can you figure it out without a protractor?

What other things can you think of that show rotations?

Angles of rotation

Rotations

We turn frequently to see objects or to hear better or to move from one place to another. Hands on clocks turn, combination locks often involve turning, and wheels turn. The mathematical model for a turn is a rotation.

$r_n(r_m(\triangle ABC)) = R_{G,\text{degrees}}(\triangle ABC) = \triangle A''B''C''$
Rotation of $\triangle ABC$ degrees° about center G

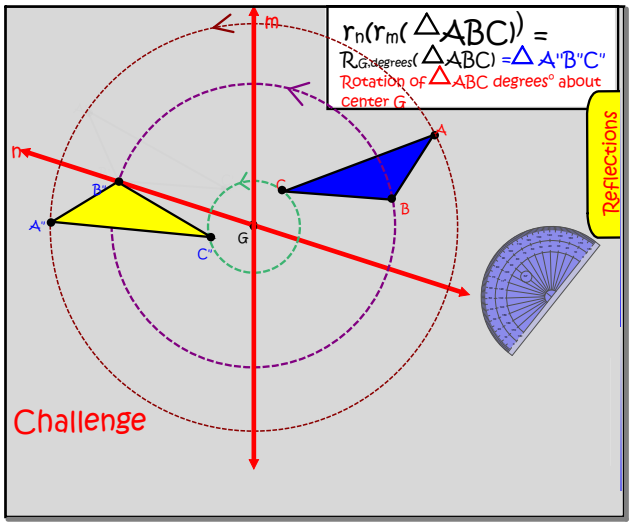
Notation

The magnitude (or amount of turn) of rotation may be any real number.

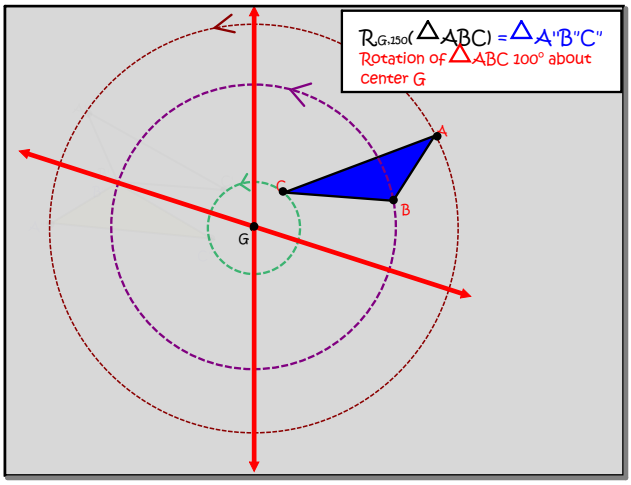
- If the magnitude is positive, the rotation is counterclockwise.

- If the magnitude is negative, the rotation is clockwise.

Magnitudes of rotations



Rotations over intersecting lines 1



Rotations over intersecting lines 2

I can only measure one existing angle made by the intersecting lines m and n (without drawing other angles) to find the angle of rotation. Which one should I measure?
Prove it!

Did you figure it out?

Prove it!

One possible proof

Proof

Quiz Yourself

Convert R_{-400} to a rotation with a magnitude in the range of -180° to 180°.

Hints
Negative angles are rotating clockwise.
There are 360° in one full rotation.
Find the angle left after taking away any full circles.

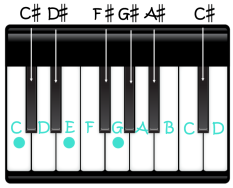
Answer - 400 - (-1)360 = - **40°** so, R_{-40}

Quiz

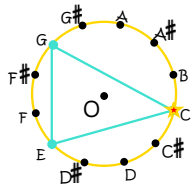
Music

Rotations can be useful in picturing repeating patterns.

Example: On a piano keyboard, the notes repeat themselves as shown below.



The three marked keys form a C-major chord.



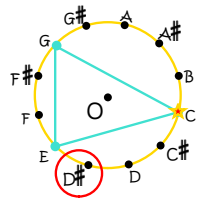
To find the notes of other major chords, place the possible notes on a circle and then rotate the triangle clockwise about the center O of the circle.

Piano chords

C♯ D♯ F♯ G♯ A♯ C♯

C D E F G A B C D

piano



Name the notes of a D♯ (D sharp) major chord.

Answer

What is the magnitude of rotation?

Answer

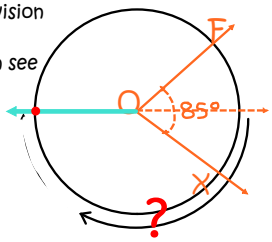
The three marked keys form a C-major chord.

chord question

piano

Rotations

Example: A fox has a limited field of view. If the fox's field of vision is 85°, how much of a turn is necessary so that the fox can see what is directly behind it?



Answer

field of vison

Rotation Challenge

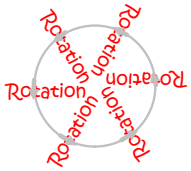
Given points A and C, draw the image of point A under a rotation of 160° about point C. Label the image A'.

A

C

Find two intersecting lines that A can be reflected over to find A' and what has to be true of the line? Why?

rotation challenge



"turn"

Notation:

click here

2 Definition:

click here

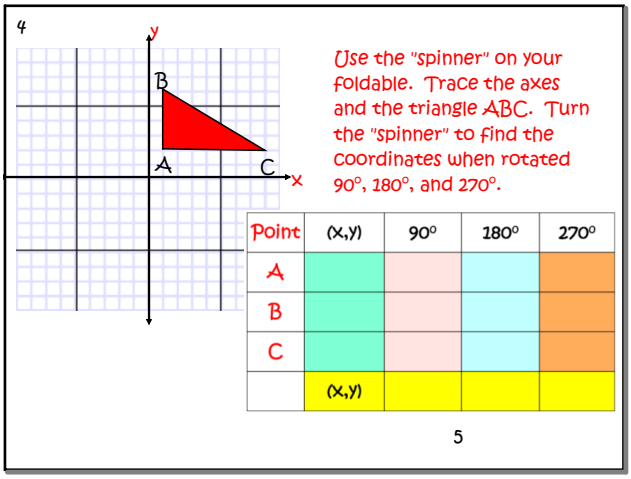
1

3

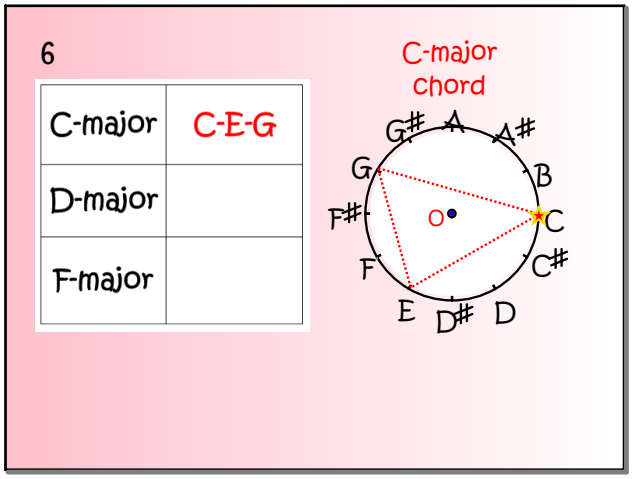
Properties:

click here

foldable info



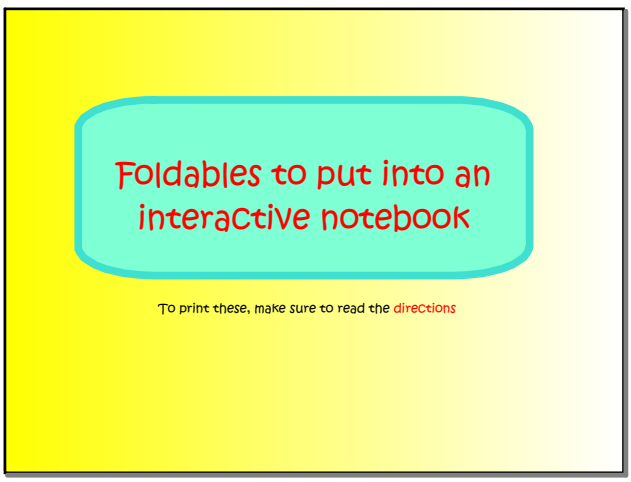
Rotation-Tchr



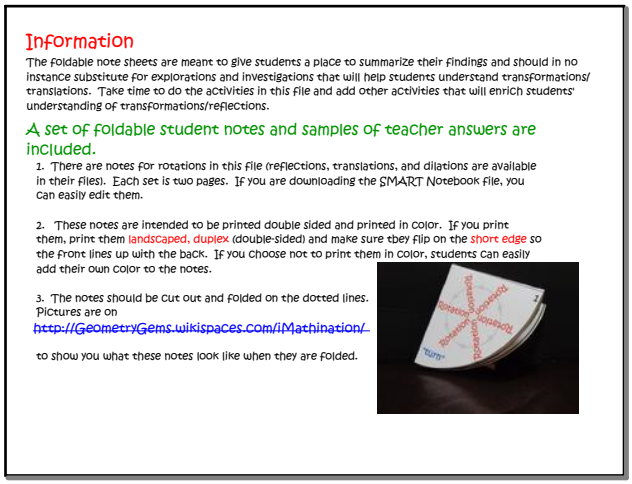
Rotation-Tchr

Thank you

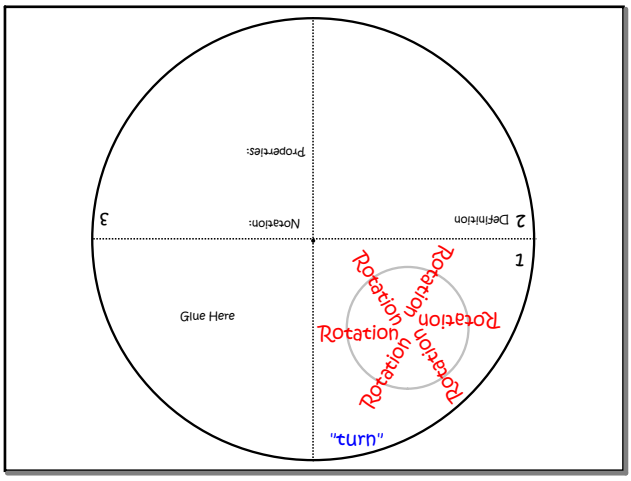
Resources



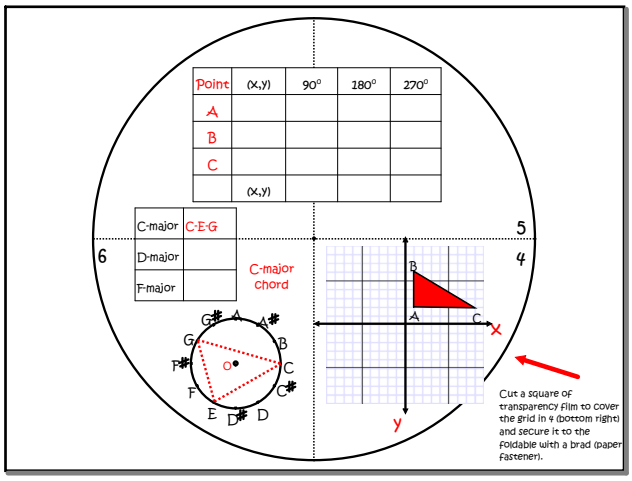
Foldables



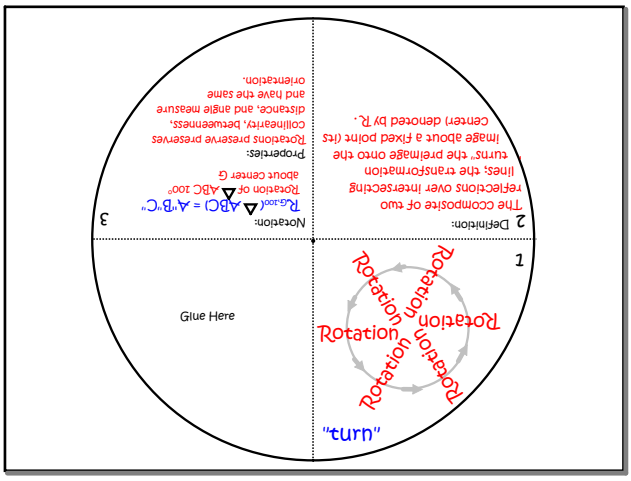
Foldable instructions



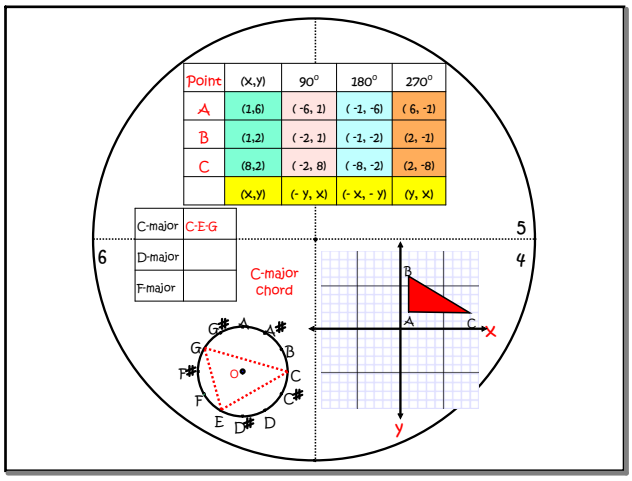
Rotation - Student page 1



Rotation - Student page 2



Rotation - Teacher page 1



Rotation - Teacher page 2